

A
Profile
of
the
Woman
Engineer



SOCIETY OF WOMEN ENGINEERS



ON THE COVER: In memory of Dr. Beatrice A. Hicks, first president of the Society of Women Engineers in 1950. In addition to serving a second term as president, Bea served on SWE's first Board of Trustees and was a SWE Board member in 1952-53, chairman of the Society's development committee in 1955-56, and member of the Board of Trustees in 1960-62 and 1962-64.

*Prepared by the 1979-80 Statistics Committee, Susan K. Whatley, Chairman
Cover design by Michael Oliver.*

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A PROFILE OF THE WOMAN ENGINEER

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INTRODUCTION

This report is based on data obtained by surveying 2424 Senior Members, Members, Award Winners, and Associate Members of the Society of Women Engineers during the winter of 1979. The responses of 1237 (94% of respondents) fully qualified women engineers were analyzed for the report, representing approximately 4% of all the graduate women engineers in the United States. In similar surveys conducted in the fall of 1977, summer of 1974, and spring of 1972, the responses of fully qualified engineers analyzed for similar reports were 1083 (98%), 438 (95%), and 346 (91%), respectively. Some data from these surveys is included for comparison purposes.

A total of 1318 individual replies (1109, 1977; 462, 1974; 380, 1972) were received, but only the returns from individuals who met the predetermined criteria established by SWE for inclusion as fully qualified women engineers were used. Responses from male members of the Society were not used. For purposes of the survey, any woman with an engineering degree or holding state registration as a professional engineer was included even if she indicated that she considered herself a manager or an administrator rather than an engineer as long as her position was engineering related. In addition, any woman employed in an engineering position but without an engineering degree was included. This group consisted mainly of individuals having degrees in mathematics, physics, chemistry, or other fields of science, plus a few exceptional individuals with less than a bachelor's degree in terms of formal education. Only those responses (1152) from women engaged in engineering or engineering related positions were used for questions which described their employment characteristics.

Since all of the respondents did not answer every question on the survey, the accompanying tables and charts reflect different numbers of total respondents in some cases. In the categories where the percentage of no responses to a question approached 1%, this is indicated in the appropriate tables and charts.

The Society of Women Engineers is the center for collection and distribution of information about women engineers in the United States. All requests for information should be addressed to the national headquarters: Society of Women Engineers, United Engineering Center, Room 305, 345 East 47th Street, New York, NY 10017.

SUMMARY

Education

Six percent of the women engineers held a doctorate, while 28% held a master's degree. The largest group was those women with a bachelor's degree, 63%, which also reflects the increasing number of women entering engineering. Three percent reported education less than a bachelor's degree. The largest number of engineering degrees was reported in the fields of chemical engineering (14%), civil engineering (12%), mechanical engineering (10%), and electrical engineering (10%).

Field of Specialization

Of 31 fields of specialization, six fields accounted for the employment of 43% of the respondents. These were chemical engineering (10%), mechanical engineering (8%), civil engineering (7%), aerospace engineering (6%), electrical engineering (6%), and computer science (6%). Of 14 work areas listed on the questionnaire, the following were predominate: industrial products/processes (20%), energy (12%), utilities (9%), aerospace (9%), consumer products (9%), and defense (9%).

Employment

Of the qualified respondents, 91% were employed full-time in engineering. The majority (69%) was employed by private industry. In addition, 8% were employed in utilities, while 7% were employed in education and nonprofit organizations and another 7% were employed by the civilian Federal/military sector.

The principal job functions related to work activity most often cited were design (20%), analysis (14%), development (13%), and administration (11%). The predominate product or service areas were aircraft/spacecraft (9%), chemicals/allied products (9%), electronic equipment (7%), and construction/civil engineering (7%).

Salaries

The average 1979 income for those reporting a salary in the questionnaire was \$24,917. The highest average salary (\$30,973) was reported by those who are self employed, but this was based on a very small sub-sample of only 12 respondents. Respondents who were members of the military reported the lowest salary, \$20,917, also based on a very small sub-sample of 7 respondents.

Registration

Twelve percent were registered Professional Engineers and 23% were Engineers-in-Training.

Age and Experience

The average age was 33, but the largest group of respondents (32%) was in the 25-29 year age category, and the second largest group (24%) was the age 24 or under. The median number of years of professional experience was not computed. However, the large influx of young women engineers into the profession is again reflected in the fact that 57% (down from 61% for 1977) of the respondents report five or fewer years of experience. The next largest group included those who had 6-10 years experience (17%).

Marital Status and Children

Fifty-one percent of the respondents were married at the time of the survey. Of all the respondents, 26% reported they had children, while those who had been or were married 42% had children.

Geographical

Respondents were most likely to come from California (18%) or New York (8).

PROFILE

The typical woman engineer whose description emerges from this study is a 27-year-old holder of a bachelor's degree in chemical engineering who has worked professionally for less than five years. She is employed full-time by a private business in the field of chemical engineering. Her area of work is in industrial products and processes, and she spends most of her time on design, analysis, and development. Although she has some administrative responsibilities, she does not directly supervise others.

She is a member of a major professional society related to her field of work, but she does not hold a state registration. Her salary in 1979 was \$24,917 up considerably from \$19,020 in 1977. She is married but has no children, and lives in Southern California.

Her east-west counterpart is a civil engineer who works for a utilities company and lives in the New York City area.

EDUCATIONAL LEVEL AND CURRICULUM

Level of Highest Degree

The bachelor's degree is the most prevalent educational level for the sample of women engineers surveyed. The proportion of bachelor's degrees is 63%; the percentage of higher degrees is 34%. Engineers with less than a bachelor's degree, who constitute about 3% of the sample, typically report having some college education, or other training, and long experience. Statistics from previous surveys are shown in parenthesis (1977, 1974, 1972).

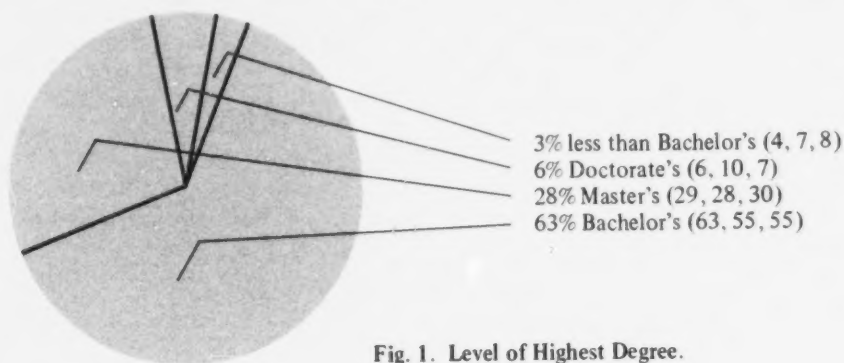


Fig. 1. Level of Highest Degree.
(1977, 1974, 1972)

Field of Highest Degree

Chemical, civil, mechanical, and electrical engineering are the fields of engineering in which the greatest number of degrees were received, together constituting almost half of all degrees. Note that Fig. 2 shows the field of highest degree received and is not restricted to bachelor's degrees. Of the 384 recipients of graduate degrees who indicated fields for both degrees (423 total recipients), 165 (43%) remained in the field of their first degree. In previous surveys 41% (1977), 45% (1974), and 57% (1972) remained in the same field. Table 1 gives the complete distribution of degrees by level and curriculum.

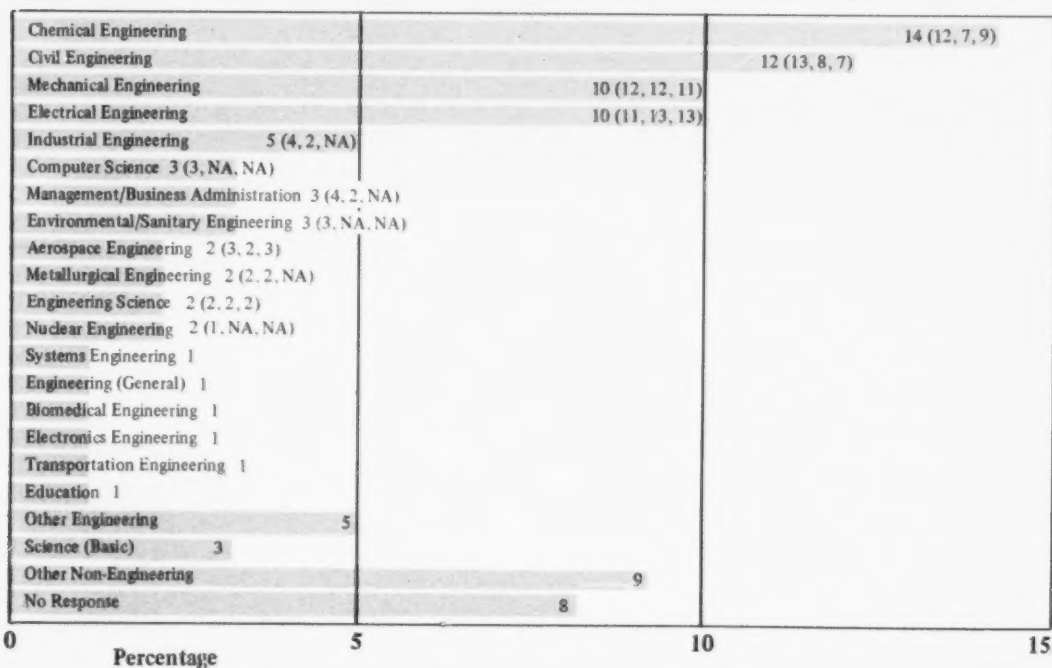
EMPLOYMENT CHARACTERISTICS

Current Employment Status

Of the 1237 respondents, 1120 (91%) were employed full-time and 32 (3%) were employed part-time in an engineering capacity. [Prior surveys show 897 (83%) of 1079 respondents and 320 (73%) of 438 respondents employed full-time in engineering capacity for 1977 and 1974, respectively.] Twelve respondents indicated that they were students, 8 full-time and 4 part-time. (It should be noted that Student Members of the Society were not included in the survey.) Twenty-two reported that they were unemployed, but only five were seeking employment.

Table 1. Number of Women Engineers by Curriculum and Highest Degree

Curriculum of Highest Degree	Total Sample						Subsample Employed Full-Time in Engineering					
	Total	Doctor	Master	Bach.	Assoc.	None	Total	Doctor	Master	Bach.	Assoc.	None
Aerospace Engineering	26	2	11	13	0	0	21	1	10	10	0	0
Agricultural Engineering	5	0	1	4	0	0	5	0	1	4	0	0
Architectural Engineering	9	0	2	7	0	0	7	0	2	5	0	0
Automation/Control	1	0	1	0	0	0	1	0	1	0	0	0
Biochemical Engineering	1	1	0	0	0	0	1	1	0	0	0	0
Biomedical Engineering	11	1	4	6	0	0	9	1	4	4	0	0
Chemical Engineering	170	3	22	145	0	0	162	3	21	138	0	0
Civil Engineering	145	4	21	120	0	0	132	3	19	110	0	0
Communications	1	0	0	1	0	0	1	0	0	1	0	0
Computer Science	42	2	19	21	0	0	35	1	17	17	0	0
Education	8	2	4	2	0	0	4	1	1	2	0	0
Electrical Engineering	120	7	30	83	0	0	108	7	28	73	0	0
Electronics Engineering	10	2	3	4	0	0	10	2	3	4	0	0
Engineering (General)	14	1	1	12	0	0	13	1	1	11	0	0
Engineering Science	22	3	6	13	0	0	21	3	6	12	0	0
Environmental/Sanitary Engineering	35	0	27	8	0	0	32	0	25	7	0	0
Geological Engineering	4	0	1	3	0	0	4	0	1	3	0	0
Industrial Engineering	55	3	13	38	1	0	52	0	11	37	1	0
Management/Business Administration	39	0	29	8	2	0	31	0	22	8	1	0
Manufacturing Engineering	1	0	0	1	0	0	1	0	0	1	0	0
Mechanical Engineering	126	4	26	95	1	0	116	3	23	89	1	0
Metallurgical Engineering	23	5	9	9	0	0	22	5	9	8	0	0
Mining Engineering	5	0	2	3	0	0	5	0	2	3	0	0
Naval Architectural/Marine Engrg.	3	0	1	2	0	0	3	0	1	2	0	0
Nuclear Engineering	19	3	10	6	0	0	18	3	9	6	0	0
Petroleum Engineering	6	0	0	6	0	0	6	0	0	6	0	0
Science	39	11	11	16	1	0	34	10	9	14	1	0
Systems Engineering	17	1	10	6	0	0	15	1	8	6	0	0
Transportation Engineering	9	0	7	2	0	0	7	0	5	2	0	0
Other Engineering	60	3	19	37	1	0	56	3	16	36	1	0
Other Non-Engineering	115	11	40	63	0	1	98	10	29	58	0	1
No Response	95	0	24	40	7	24	89	0	21	38	7	23
Totals	1236	69	354	774	13	26	1119	62	305	715	12	25

Fig. 2. Field of Highest Degree (NA = Not Available).
(1977, 1974, 1972)

Employment Status by Degree

It is interesting to examine the employment status of the holders of each degree in light of the recent upsurge in demand for women engineers. Table 2 shows that for all degree levels, women were employed full-time in engineering at rates greater than 85% compared to greater than 80% for 1977 and greater than 71% for 1974. Those respondents with no degree had an employment rate of 96% employed full-time in engineering (up from 68.3% in 1977 and 71% for 1974).

Table 2. Employment Status by Highest Degree

Category	% of Holders of Given Degree (N = total number of holding degree)					
	Total (N=1236)	Doctor (N=69)	Master (N=354)	Bachelor (N=774)	Associate (N=13)	None (N=26)
Employed Full-Time in Engineering	91	90	86	92	92	96
Employed Full-Time not in Engineering	3	6	6	2	8	
Employed Part-Time in Engineering	3	3	4	2		
Employed Part-Time Because Student			1			
Unemployed, Seeking Employment		1		1		
Unemployed, Not Seeking Employment	1		1	2		
Full-Time Student	1		1	1		
Retired	1		1			4

Type of Employer

The majority of the full-time and part-time engineers was employed by private industrial or business organizations as shown in Fig. 3. Total distribution by types of employers is shown in Table 3.

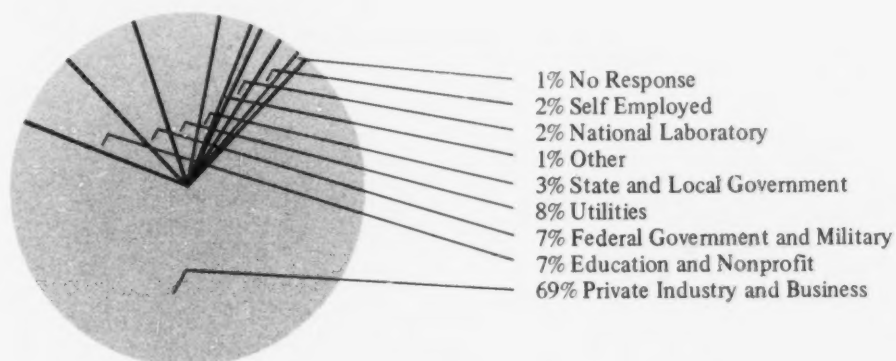


Fig. 3. Type of Employer.

Table 3. Type of Employer (1977, 1974, 1972)

Employer	Number of Employees
Private Industry or Business	798 (694, 263, 200)
Utilities	90 (84, NA, NA)
Federal Government, Civilian Employer	72 (77, 44, 41)
College or University	60 (73, 42, 31)
National Laboratory	23 (NA, NA, NA)
State Government	22 (22, 13, 9)
Nonprofit Organization (Other than School)	22 (20, 14, 6)
Self Employed	18 (19, 20, 13)
Local Government	11 (11, 5, 3)
Military Service	8 (11, 6, 5)
Junior College or Technical Institute	6 (5, 2, 2)
Secondary, Elementary or Other School	0 (2, 2, 1)
Other	12 (19, 7, 11)
No Response	10
TOTAL	1152 (1083, 418, 322)

NA = Not available.

Employment Functions

Respondents (1120 employed full-time in engineering and 32 part-time) were given a list of twelve job functions from which to select the one most descriptive of their current engineering employment. The functions most frequently selected were design, analysis, and development. Figure 4 shows the distribution of principal job function. In addition, 26% of the respondents reported that they were managers of their function.

Respondents were also asked to report more than one function, if appropriate. Table 4 shows the distribution of the respondents who reported additional functions. Secondary job functions identified most often were the same as for primary functions: design, development, analysis, and administration. For a third function, respondents cited planning and analysis.

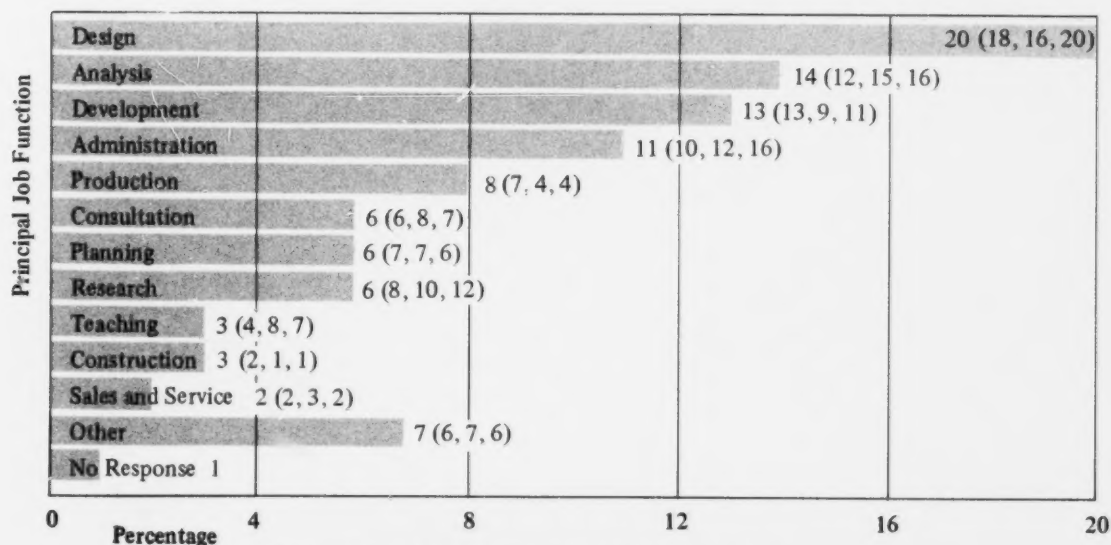


Fig. 4. Principal Job Function (NA = Not Available).
(1977, 1974, 1972)

Table 4. Additional Employment Function

Respondents Reporting	Total	Percentage of All Respondents
Second Function	1003	87
Third Function	729	63

Supervisory Responsibility

Respondents were asked to select their level of supervisory responsibility from the six categories shown in Fig. 5. The results show that 35% of the women engineers were managers or supervisors providing direct supervision over components ranging from teams or small units up to major organizations, 23% had indirect or staff responsibilities and 40% had no supervisory responsibilities.

Although the percentage of women in supervision is fluctuating (35% in 1979, 34% in 1977, 40% in 1974, and 40% in 1972), the total number of women is increasing (404 in 1979, 369 in 1977, 175 in 1974, and 138 in 1972).

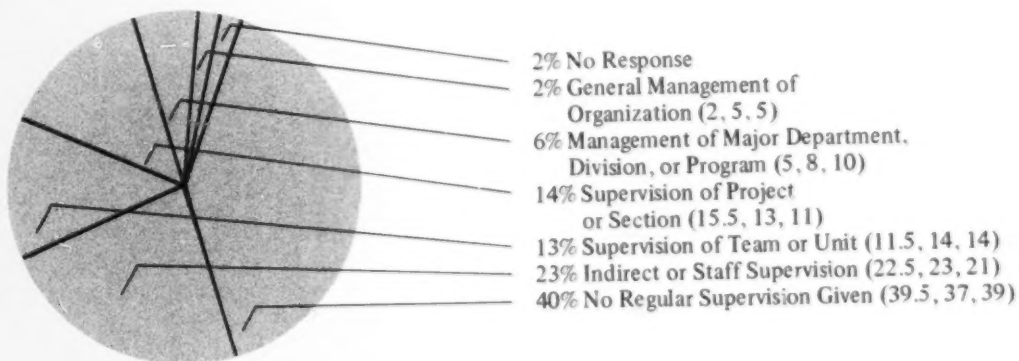


Fig. 5. Supervisory Responsibility.
(1977, 1974, 1972)

Product or Service

Products and services related to engineering work were grouped into 21 categories for this study. The variety of products and services with which the respondents were involved is readily apparent from Fig. 6, and clearly no industry can be singled out as having a dominant position in the employment of women engineers.

Specialization by Field

Respondents were asked to identify the field of specialization in which they were employed. Results given in Fig. 7 are percentages of the full-time and part-time engineering subsample of 1152 respondents. Categories comprising less than 1% included Biochemical Engineering, Engineering Science, and Naval Architectural/Marine Engineering.

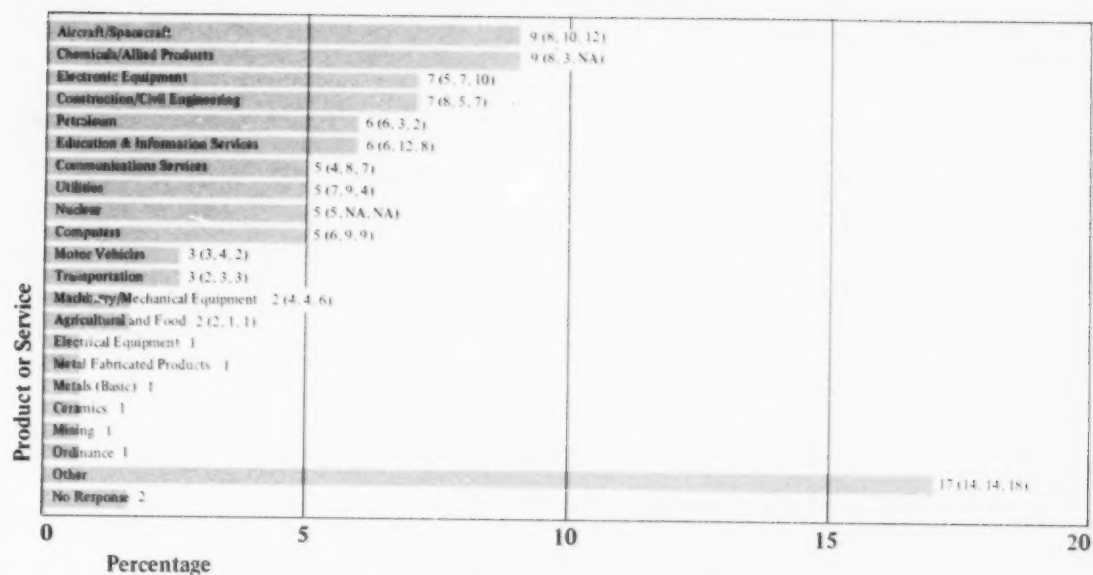


Fig. 6. Product or Service (NA=Not Available).
(1977, 1974, 1972)

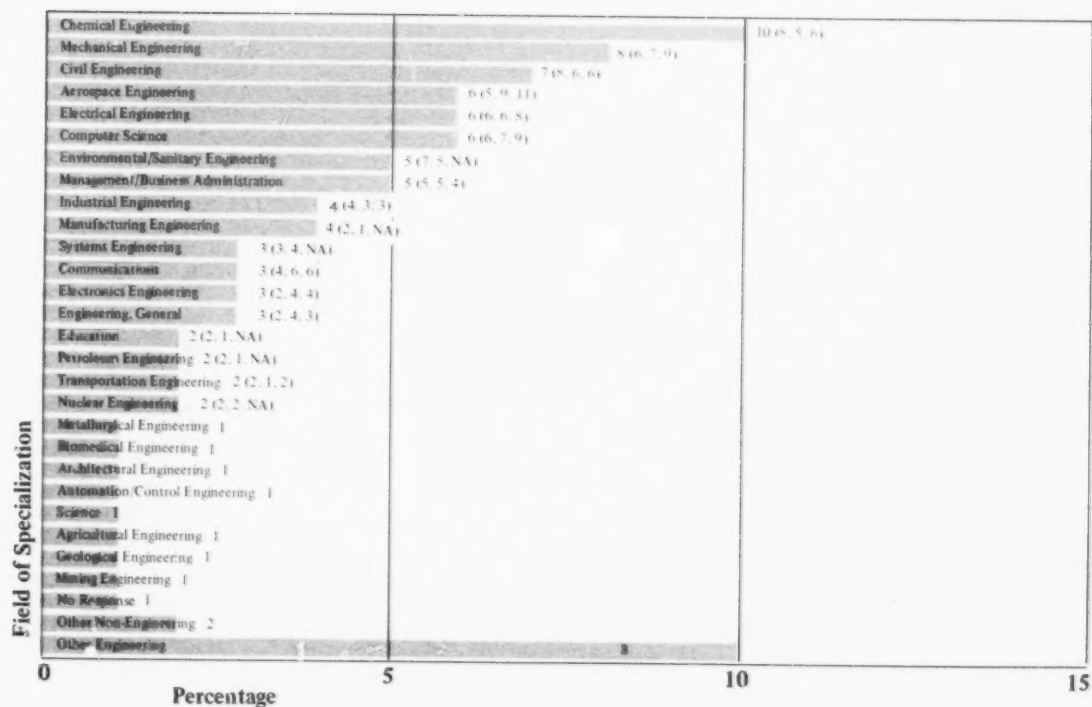


Fig. 7. Field of Specialization (NA = Not Available).
(1977, 1974, 1972)

Area of Work

Respondents were asked to identify, from a list of fourteen, the area relating to a major portion of their work. The total sample consisted of 1152 respondents, including 25 (2%) who did not identify an area of work (No Response). Urban development was cited by 5 respondents but comprised less than 1% of the total sample. Results are shown in Fig. 8.

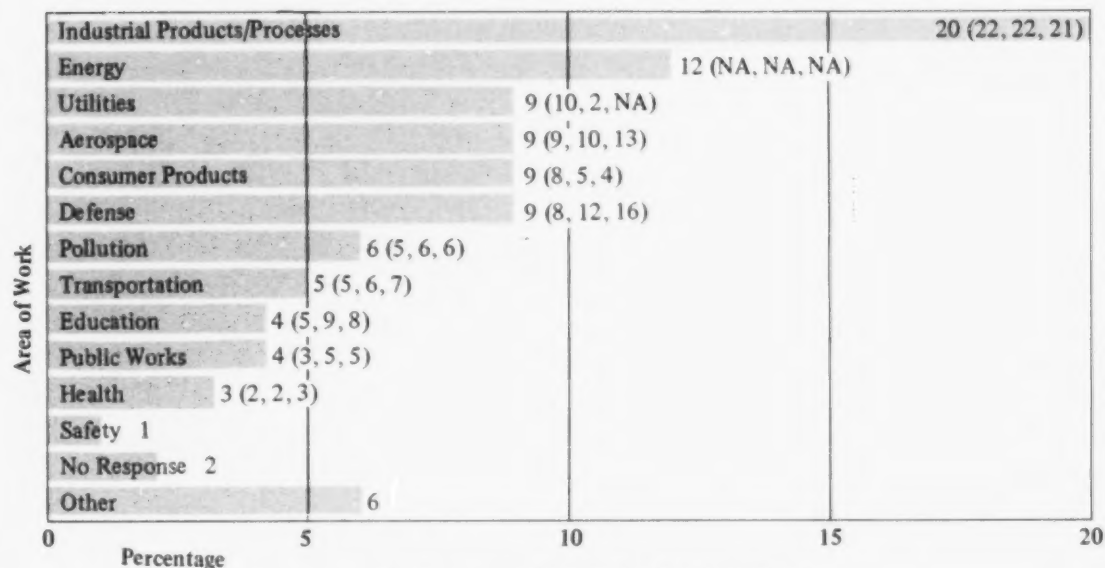


Fig. 8. Area of Work (NA = Not Available).
(1977, 1974, 1972)

Years Unemployed and Years Employed Not in Engineering

Respondents were asked to report the number of years they had been unemployed, voluntarily and involuntarily; the results are shown in Table 5. Table 6 shows the distribution of the number of years respondents reported being employed in areas other than engineering. It is important to note that some of the women rearing children at home considered this activity as non-engineering employment, while others considered it as unemployment. As a consequence, the percentages of women engineers unemployed (i.e., job seeking) and employed in areas other than engineering are somewhat misleading. Only 5 respondents were seeking employment.

Table 5. Years Unemployed

Years	Percentage	
	Voluntarily	Involuntarily
Zero, or none reported	85	94
1 to 5	9	6
6 to 10	3	
11 to 15	1	
16 to 20	1	
21 to 25	1	

Table 6. Years Employed Not in Engineering

Years	Percentage
Zero, or none reported	75
1 to 5	16
6 to 10	5
11 to 15	2
16 to 20	1
21 to 25	1

GENERAL CHARACTERISTICS

Age and Experience

The average age of all women engineers responding to the survey was 33 years and the average age of registered Professional Engineers was 40. The age distribution is shown in Fig. 9, and the distribution for years of professional engineering experience is shown in Fig. 10.

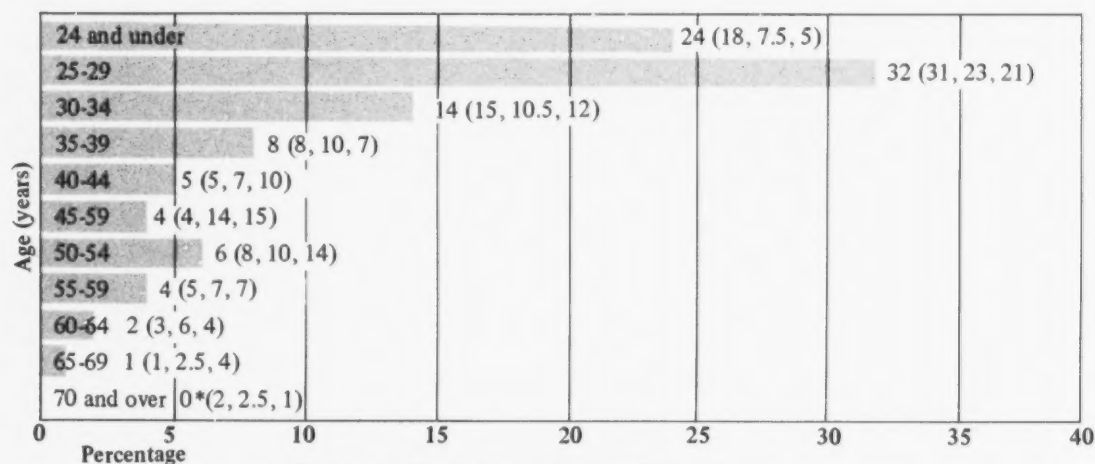


Fig. 9. Age Distribution of Women Engineers.
(*5 responses, but less than 1% of sample)

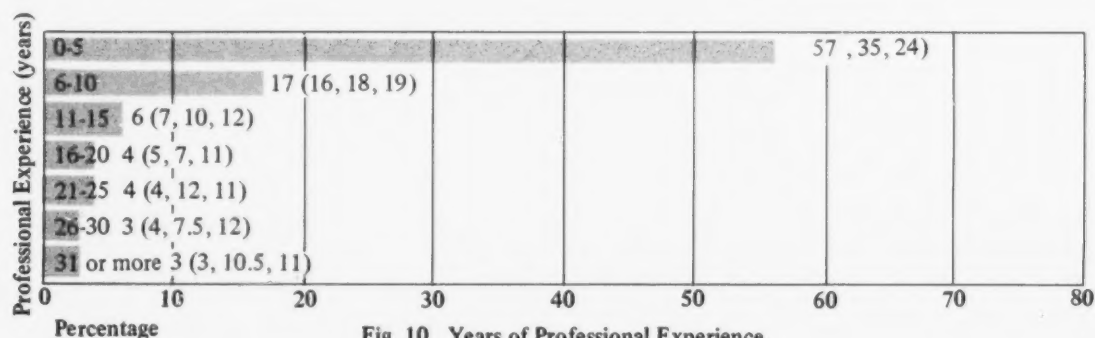


Fig. 10. Years of Professional Experience.

Registration

Twelve percent of the respondents held a Professional Engineer (PE) license and 23% were licensed as Engineers-in-Training (EIT). Fifty-nine percent of the respondents with PE licenses held degrees beyond the bachelor's degree. Only four of them (out of a total of 146) held less than a bachelor's degree. Slightly more than half of the PE's were civil, mechanical, electrical, or environmental engineers, while the remainder were distributed among a variety of specialties. The average income reported by Professional Engineers for 1979 was \$27,537 for 136 respondents. This compares to an overall average income of \$24,917 for the 1173 respondents in the total sample who reported their salary. The average age of EIT's was 26 and their average salary was \$21,569 for the 273 responses.

Other Societies

Seventy-two percent of the respondents are also members of other professional societies, many of whom listed membership in more than one society.

Geographical

The state of residence was ascertained for 1237 respondents. Thirteen states had 25 or more residents each, accounting for 72% of the sample. The distribution is shown in Fig. 11. There were no respondents from South Dakota, Montana, or Arkansas.

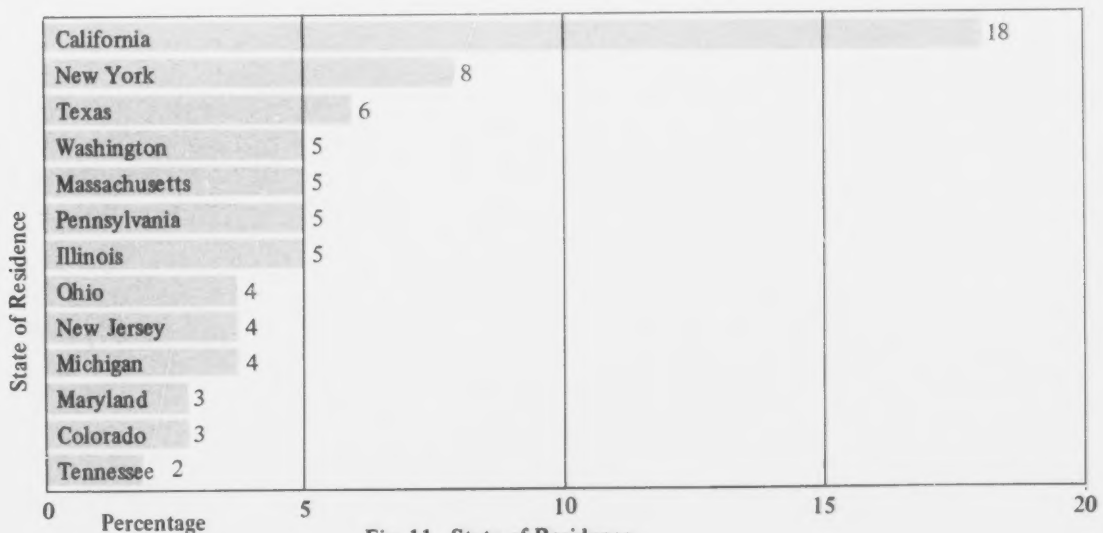


Fig. 11. State of Residence.

Marital Status

Fifty-one percent of the respondents were married, 37% were single, 9% were divorced and 2% were widowed. Of the 62% who are currently or once were married 42% have children.

Children

Three-hundred twenty-two, or 26%, of all respondents had children. The distribution of the number of children reported is shown in Table 7.

Table 7. Number of Children Reported
by Respondents

Number of Children	Percentage
One	36
Two	34
Three	20
Four	6
Five or More	4

Citizenship

Of the 1237 respondents, over 97% were U. S. citizens, with 22 individuals reporting non-U. S. citizenship.

SALARY

Engineering Income

Respondents were asked to report their gross income (before taxes) for the year 1979 including salary, commissions, and bonuses or fees but excluding that part of their income which had no relation to their work such as stocks and bonds, rents, inheritances, etc. The average income of the total sample was \$24,917. The distribution is given in Fig. 12. The total number of respondents who reported their income for the survey was 1173.

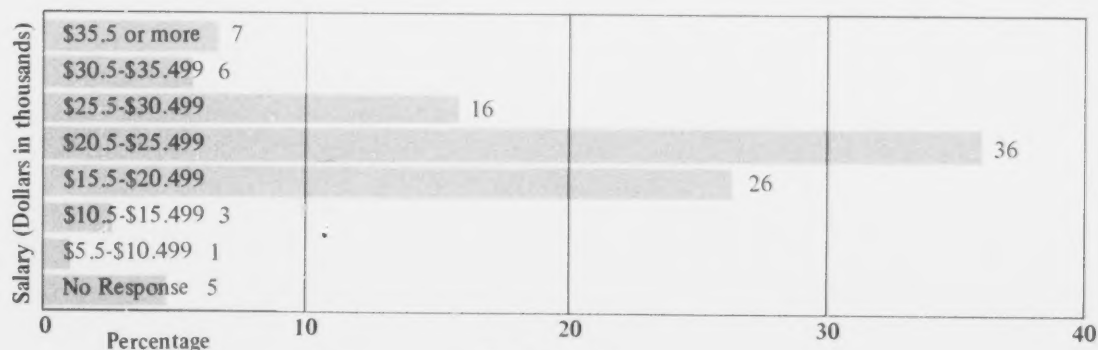


Fig. 12. Salary.

Salary vs. Educational Level

Results of an analysis of the educational level represented in the various salary ranges are presented in Fig. 13. The salary ranges versus educational level are shown in Fig. 14.

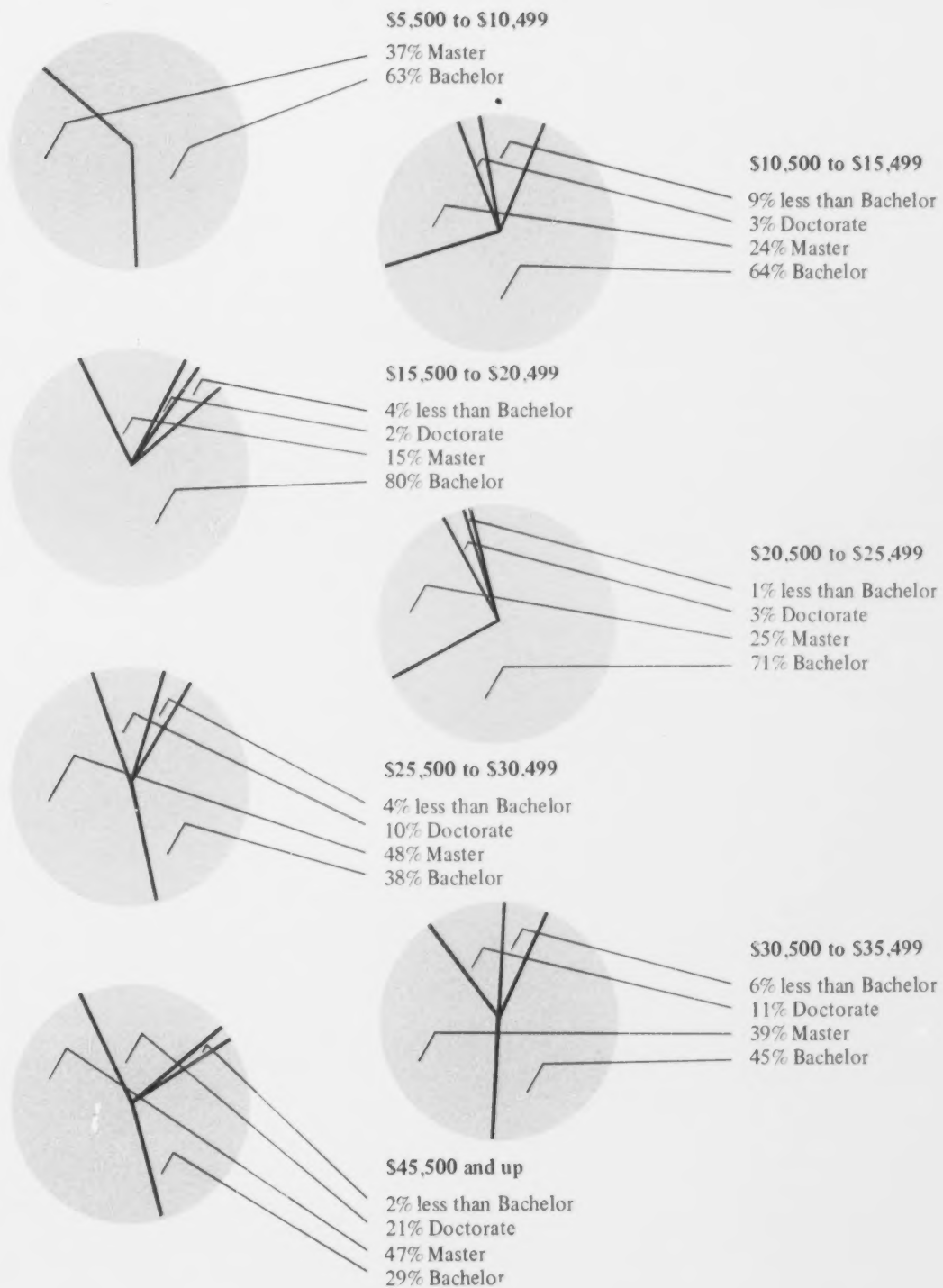


Fig. 13. Salary vs Educational Level.

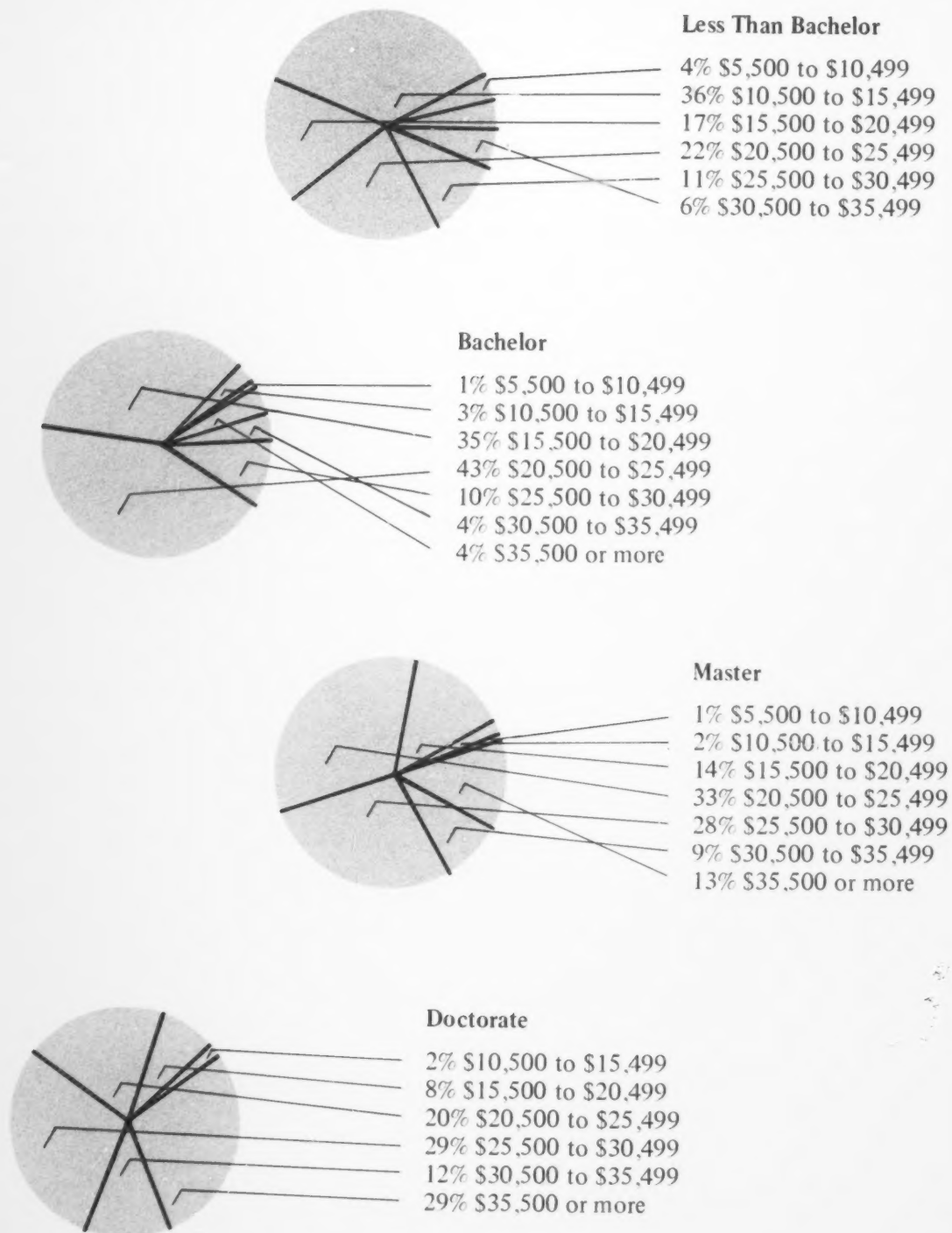


Fig. 14. Educational Level vs. Salary.

Salary vs. Experience

Years of professional experience represented in the various salary ranges were also analyzed, and the results are given in Figs. 15 and 16.

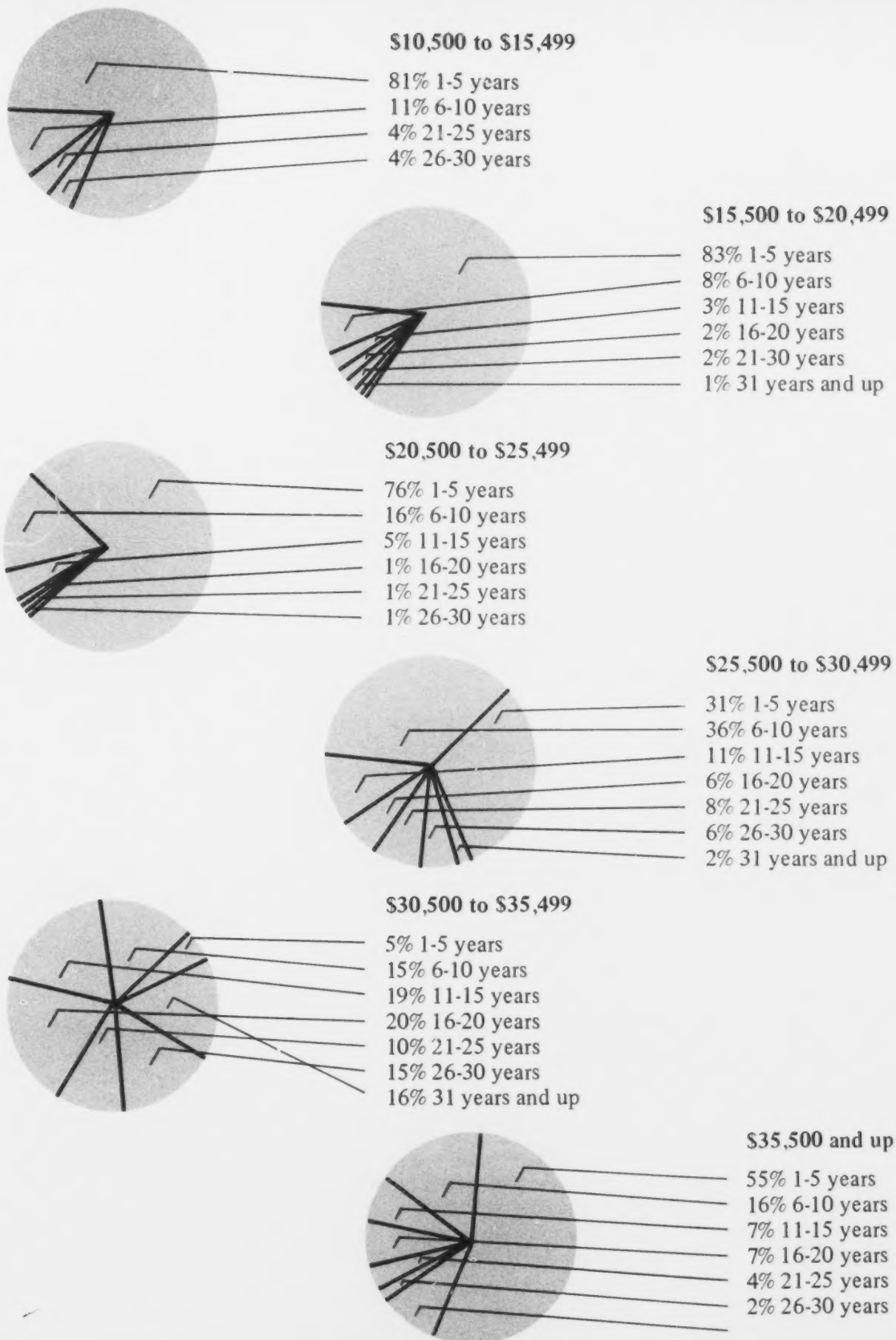


Fig. 15. Salary vs. Years of Experience.

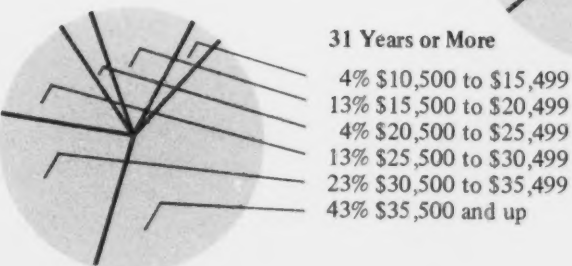
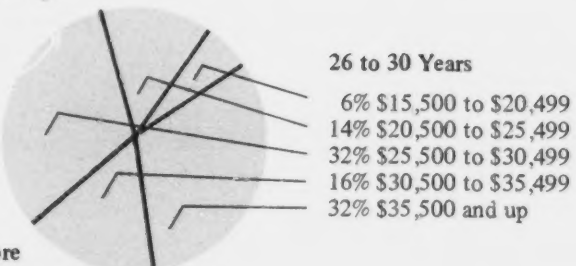
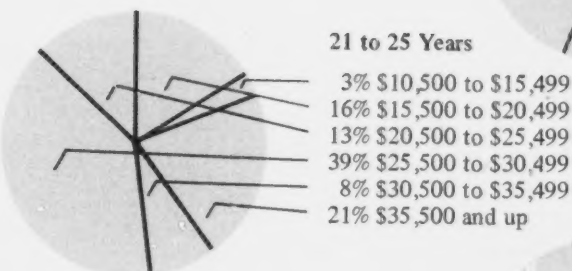
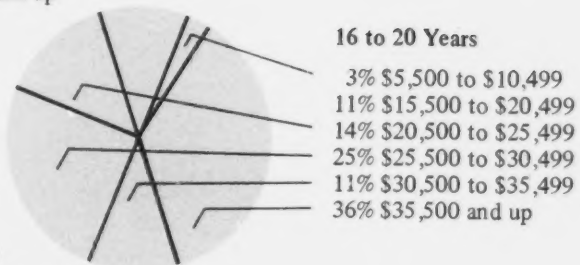
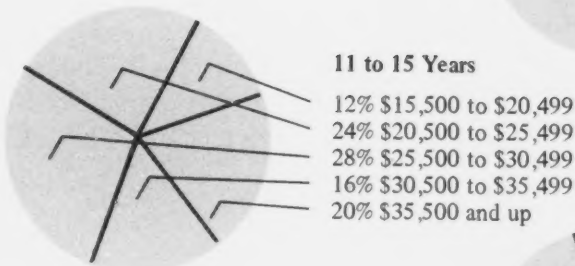
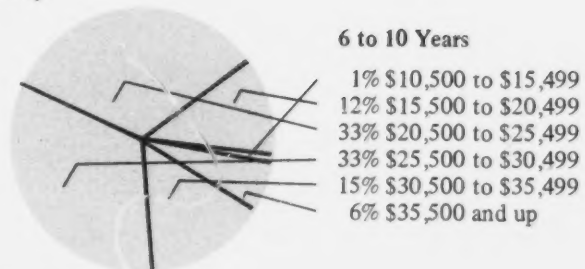
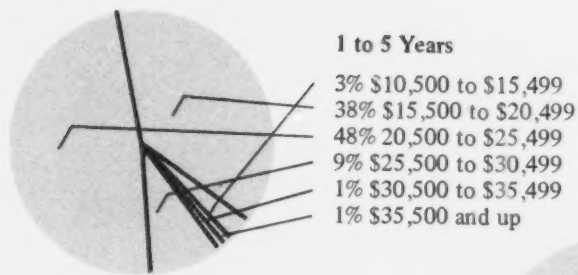


Fig. 16. Years of Experience vs. Salary.

Salary by Marital Status

The salaries earned by single and married women are given in Table 8.

Table 8. Salary vs. Marital Status

Thousands of Dollars	Percentage of	
	Married Women	Single Women
5.5 to 10.49	1	1
10.5 to 15.49	3	2
15.5 to 20.49	22	31
20.5 to 25.49	36	37
25.5 to 30.49	18	13
30.5 to 35.49	7	5
35.5 and up	7	8
No Response	6	3

Effect of Type of Employer on Salary

The mean salaries of women working for four major categories of employers are tabulated in Table 9.

Table 9. Mean Salary by Type of Employer

Type of Employer	Mean Salary	Number of Respondents	Percentage of Total Respondents (1117)
Private Industry	\$24,845	750	67
Utilities	26,666	87	8
Federal-Civilian	24,558	71	6
College or University	25,623	57	5

Salary vs. Children

The average salaries for women with and without children were determined and are given in Table 10.

Table 10. Salary vs. Children

Respondents Employed Full-Time in Engineering:	Average Salary	Number of Respondents
with children	\$26,734	288
without children	\$24,326	885